

## CLAIMS

### WHAT IS CLAIMED IS:

1. A transmitter that comprises:

a constellation encoder configured to receive a sequence of n-bit data words and  
configured to convert the sequence of data words into a sequence of m-bit  
constellation signal point labels; and  
a modulator configured to receive the sequence of signal point labels and configured to  
responsively generate at least one amplitude-modulated bi-valued function having  
an amplitude in each symbol interval determined by a corresponding signal point  
label in the sequence of signal point labels.

2. The transmitter of claim 1, wherein the modulator is further configured to generate a second  
amplitude-modulated bi-valued function that is orthogonal to said at least one amplitude-  
modulated bi-valued function, wherein the amplitude-modulated square waves are summed to  
produce a modulated signal.

3. The transmitter of claim 1, wherein the bi-valued function is any Walsh function.

4. The transmitter of claim 1, wherein the modulator is a digital circuit.

5. A method of data communication, comprising:

receiving a sequence of data words;

converting the sequence of data words into a sequence of sets of constellation signal point

coordinate values, wherein the sequence of sets can be represented as:

$$(x_{1k}, y_{1k}, x_{2k}, y_{2k}, \dots, x_{(d/2)k}, y_{(d/2)k}), k=1, 2, \dots,$$

wherein k is the sequence index, and d is the dimensionality of the constellation;

and

producing a modulated signal  $M(t)$  that can be represented as:

$$M(t) = \sum_k \sum_{j=1}^{d/2} (x_{jk} \cos(j, t - kT) + y_{jk} \sin(j, t - kT))$$

wherein T is a symbol period.

6. A receiver that comprises:

- 5        an analog-to-digital converter configured to convert a received signal into a sequence of samples, wherein multiple samples are taken in each symbol period;
- a circuit configured to manipulate the sign of the sequence of samples in accordance with a Walsh function, and further configured to sum the resulting values over each symbol period.

7. The receiver of claim 6, further comprising:

- a second circuit configured to manipulate the sign of the sequence of samples in accordance with a second, different Walsh function, and further configured to sum a second set of resulting values over each symbol period; and
- a decision element configured to convert the resulting values into a sequence of signal constellation points.
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8. The receiver of claim 7, further comprising:

- a constellation decoder configured to convert the sequence of signal constellation points into a sequence of n-bit data words.